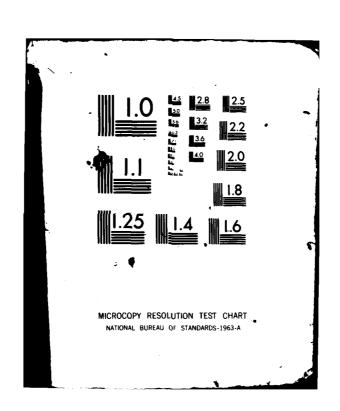
AIR FORCE AEROSPACE MEDICAL RESEARCH LAB WRIGHT-PATT--ETC F/G 1/2 USAF BIOENVIRONMENTAL NOISE DATA MANDBOOK. VOLUME 165. MC-1 HEA--ETC(U) AD-A116 151 JUN 82 T H RAU
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Bioenvironmental Noise

Ground Support Equipment

MC-1 Heater, Duct Type, Portable

20. AGTRACT (Continue on reverse side if necessary and identify by block number)

The MC-1 heater is a gasoline-motor driven, portable ground heater used primarily for cockpit and cabin temperature control. This report provides measured and extrapolated data defining the bioacoustic environments produced by this unit operating outdoors on a concrete apron at normal rated conditions. Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise levels, and limiting times for total daily exposure of personnel-

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with and without standard Air Force ear protectors. Far-field data measured at 36 locations are normalized to standard meteorological conditions and extrapolated from 10 - 1600 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application," AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.

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# **PREFACE**

This report was prepared by the Biodynamic Environment Branch, Air Force Aerospace Medical Research Laboratory, under Project/Task 723107, Measurement and Prediction of Noise Environments of Air Force Operations.

The author gratefully acknowledges Mr. John N. Cole for his assistance in preparing this report, Mr. Robert G. Powell for his assistance in acquiring the raw data, Mr. Henry T. Mohlman and Mr. Fred D. Lampley of the University of Dayton for their assistance in the mechanics of data processing, and Mrs. Norma J. Peachey who typed and prepared the graphics.



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## INTRODUCTION

The MC-1 heater is a gasoline-motor-driven, portable ground heater used primarily for cockpit and cabin temperature control. This unit is manufactured by the American Air Filter Company, Inc.

This volume provides measured and extrapolated data defining bioacoustic environments produced by this unit. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the MC-1.

This volume is one of a series published by the Air Force Aerospace Medical Research Laboratory (AFAMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and ground support equipment. The far-field, community-type, noise data in the handbook describe the noise produced during ground operations of aircraft, ground support equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Refer to Volume 1 (reference 1) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., inflight/flight crew and passenger noise, near-field ground crew nosie, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published and is available upon request from AFAMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of each updated index as it is generated.

Direct any questions concerning the technical data in this report and other handbook volumes to: AFAMRL/BBE, Wright-Patterson AFB, OH 45433; AUTOVON 78-53675 or 78-53664; Commercial (513) 255-3675 or (513) 255-3664.

Cole, John N., USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application, AMRL-TR-75-50(1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.

### **NEAR-FIELD NOISE**

#### **MEASUREMENT**

A standard MC-1 heater was operated outdoors on a concrete apron at normal rated conditions. Table 1 notes the surface meteorological conditions at the time of measurement.

Figure 1 identifies 72 noise measurement locations at a height of 1.5 meters above the concrete apron (nominal ear level of ground crew). The 0 degree reference direction passes through the tow bar. The 36 locations on the two inner circles are in the acoustic near-field of the source where the sound wave fronts generally do not spherically diverge and the source appears to be spatially distributed (i.e., not a point source). Consequently, these near-field data cannot be extrapolated to longer distances but do properly define the levels at locations close to the unit.

Near-field measurements were also made at ear level at the operator control panel. Table 1 lists the numeric/alphabetic designator used on the data pages in this report to identify the operator measurement location and test condition. The designator 1/A means operator location 1 and test condition A. Such a descriptor is essential in many handbook volumes that involve multiple combinations of locations/conditions. It is used in this report to maintain format consistency.

#### RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced by the MC-1 unit at the 37 specified, near-field locations. This table includes the overall, 1/3 octave band, and octave band levels. From these data one can calculate the variety of measures in Table 3 which are widely used to assess the effects of noise on personnel and their performance.

For data at other intermediate near-field locations (i.e., for radial distance less than 10 meters) you can interpolate between the 72 measured data points. All near-field data are for the meteorological conditions at the time of test but are valid for all typical airbase meteorology because of the short distances over which the sound is propagated.

#### TABLE 1

# MEASUREMENT LOCATIONS AND TEST CONDITIONS FOR OPERATOR NOISE MEASUREMENTS

MC-1 Heater, Duct Type, Portable Tyndall AFB, 19 June 1980 NSN 4520-01-012-2044, Field # F107

Magazinamant I agatian

Measurement Location	Operator Control	Panel
Operation	•	
<b>A</b>	3400	RPM
Meteorology		
Temperature	29	$^{0}\mathbf{C}$
Bar Pressure	.761	M Hg
Rel Humidity	69	9%
Wind - Speed	3.1	M/Sec (6 Kts)

# **FAR-FIELD NOISE**

#### **MEASUREMENTS**

Noise measurements were also made on the same MC·1 unit under the same test conditions at the outer circle locations on Figure 1. These 36 locations are in the acoustic far-field of the source where the sound wave fronts spherically diverge and the unit may be regarded as a point noise source. Under these far-field conditions, the measured data can be extrapolated to longer distances.

#### **RESULTS**

Table 4 lists the overall and 1/3 octave band SPL measured at the 36 far-field locations under the meteorological conditions at the time of test. These data were normalized to 10 meters distance and standard meteorological conditions (15C temperature, 70% rel humidity, 0.760 meter Hg barometric pressure) and used to derive the graphic data in Figure 2 which provides a compact summary of the far-field noise characteristics of the MC-1 heater in a standard format.

These measured data were also used to derive sets of equal noise contours (Figures 3through 9) describing seven different measures of noise as functions of angle and distance from the source for standard day meteorology. Note that Figure 8 contours identify limiting exposure times for personnel. Missing data points on any of the contours are the result of eliminating measured data which contained excessive influence of spurious background noise present at the time of measurement. In some cases contour levels at these missing data points were estimated and indicated with dashed lines.

	MEASURED SOUND PRE 1/3 OCTAVE BAND											) OME	TIFICA GA 3.	2		
	FCE/SUBJECT:		ERATI 3400	ONE			)		~			) TEST BA-000-0 ) Run 01 )				
PORTABLE	Ē.	i					i					1 25	JAN 82			
NEAR FI	ELD NOISE LEVELS	(					} }					) ) PAG	E F1			
						ncarto	N/COND				*					
	DISTANCE (H) ->	4	4	4	4	4	4	4	4	4	4		4	4		
FREQ (HZ)	ANGLE (DEG)> CONDITION>	) A	<b>4</b>	40	60 A	8 G 4	100 A	120 A	140 A	160 4	180 A	200	8 2 0 A	240		
25																
31.5 40		77 <	77<	77<	76 <	75∢			78<	77<	78<	75<	77<	79		
50		85	85	84	8.3	81<	88<	79<	794	79∢	75<	79∢	81<	8.2		
63		84	84	83	824	81 <	804	79<	794	93	794	79<	80<	824		
80		74<	73<	72<	72 <	73<	73<	72<						72		
100		71 <	684	71<	74	76	75	73	76	75	7.2	724	72<	74		
125		73	74	76	78	78	76	75	78	77	75	75	76	77		
160		75	75	76	79	80	6.0	80	79	52	8.2	79	80	80		
200		71	70	70	72	72	70	71	71	72	72	71	70	70		
250		75	75	73	71	72	71	72	74	75	75	74	72	71		
315		80	79	76	71	68	70	73	75	76	76	75	75	75		
400		50	79	76	73	75	77	72	78	75	73	74	79	75		
500		78	76	76	71	72	70	72	73	72	75	72	72	75		
630 800		77 76	76 73	74 73	71 71	71 68	74	71	74	71 68	72 69	71 67	72 68	71 68		
1000		77	73	74	70	67	68 66	68 65	68 70	58	65	66	71	71		
1250		74	73	73	70	68	68	66	67	67	65	65	67	69		
1600		71	71	70	68	63	62	62	62	62	61	63	64	63		
2300		71	71	68	65	62	60	60	61	51	60	62	63	63		
2500		72	71	73	67	65	62	62	63	51	63	61	64	63		
3150		73	72	70	67	62	60	61	61	68	60	61	63	63		
4000		70	70	60	95	59	57	57	57	57	56	57	59	59		
5000		68	68	62	63	56	55	55	55	56	54	56	58	57		
6300		67	65	64	62	56	53	53	54	54	52	55	57	55		
9000		66	67	64	63	55	55	54	55	54	54	55	58	57		
10000		63	62	62	60	51	51	51	51	<del>5</del> 0	49	52	55	54		
OVERALL		91	90	89	89	88	87	86	88	38	88	86	88	89		

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	PPI GNUO PPI 1/3 OCTAVE BAND	SSURE	LEVEL	(09)								) OME	TIFICA GA 3.	2
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MC-1 HEA		(	3400	RPH			,					)	JAN 82	
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WCHA / 12	LED NOTSE ECVEES	i					í					) PAG	E F2	
						OCATIO	IZCOND	ITION						
	DISTANCE (M) ->	4	4	4	4	4	2	2	2	2	2	Z	?	2
FREG	ANGLE (DEG)>	260	280	300	321	340	0	50	40	60	80	100	120	140
(HZ)	CONDITION>	Δ	Δ	Α	A	Δ	A	A	A	4	A	A	Δ	A
25														
31.5		77 <	77<	755	79<	75 <	69<	79<	78<	77<	7°<	77<	76<	77<
<b>4</b> 0														
5 D		33	b 3	84	33	83	e 7	57	86	35	8 4	62	8.3	81<
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3.0		73<	75<	75<	75<	73<	74<	76<	75 <	74<	71<	70<		
100		74	72<	72<	72<	73<	7 3	74	75	74	74	72	73	73
125		76	76	77	75	724	77	7.4	76	76	76	75	77	78
160		76	75	80	8?	83	81	79	80	31	79	7 <b>6</b>	79	85
200		70 73	70 74	70 74	72 75	73 75	62	82	51 81	78 79	75 78	72 77	71 73	75 75
25 0 31 5		75	74	74	76	75 79	85 85	83 82	82	90	77	76	74	73
400		73	74	72	77	90	82	83	83	77	79	79	81	80
500		73	74	73	77	81	P 3	83	81	75	75	76	75	50
630		ر7 د7	73	74	73	76	e 3	63 63	78	73	75	74	74	74
800		67	68	69	71	72	79	80	77	72	72	71	70	72
1000		69	72	71	74	75	82	80	77	73	72	71	72	7 1
1256		65	69	72	73	73	£ 0	79	78	73	15	71	78	70
1600		63	65	64	72	75	78	77	76	á 9	65	66	67	56
2000		63	66	68	71	73	79	75	73	69	66	65	65	64
2500		63	56	69	72	74	79	77	74	71	67	67	66	65
3150		63	65	67	70	74	78	76	74	69	65	55	65	65
4000		23	61	65	67	70	75	74	72	56	62	61	61	61
5000		58	59	64	66	68	74	72	70	64	61	<b>6</b> 0	61	60
6300		55	58	63	65	69	7 1	71	69	51	59	58	58	58
8000		57	59	63	65	67	70	70	69	62	59	58	58	59
10030		53	54	63	6.3	63	65	65	65	59	>6	56	55	56
OVERALL		30	89	89	90	91	95	94	93	31	90	89	89	90

<sup>&</sup>lt; LEVEL CORRECTED TO REMOVE BACKGROUNDZELECTRONIC NOISE.

ABLEL	MEASURED SOUND PRE	ESSURE	LEVEL	(03)								) ICENTIFICATION:
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100		74	77	75	73	7→	74	74	71<	594	63<	80
125		78	79	78	76	77	77	76	75	714	73	87
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200		50	61	8.0	77	76	74	73	74	78	81	8.2
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315		76	79	76	73	75	77	79	77	79	8.2	89
400		30	81	65	83	79	79	78	77	79	8 3	8 *
500 630		79 75	7 A 7 S	83 76	8 0 7 7	77 73	76 76	76 75	75 74	77 77	8.4	85 83
800		73	73	74	72	71	71	72	72	75	81 75	77
1000		72	71	72	74	72	74	72	75	81	79	76
1250		71	71	71	7.3	74	74	73	74	78	79	77
1600		65	66	67	58	67	67	69	71	76	8.0	71
2000		65	64	65	65	65	65	67	70	74	7.7	70
2500		65	65	66	66	<b>b</b> b	<b>b</b> 8	68	71	76	79	6.5
3150		65	65	66	66	65	6 <b>6</b>	67	7 1	76	7.3	67
4000		61	65	62	65	5ه	6	67	71	74	78	67
5000 6300		61 54	60 57	61 59	6.3	62	63	63	67	71	7 -	64
5000		59 59	57 58	59 59	6ù <b>6</b> 1	61	F ()	60 60	64 65	59 71	71 70	62 63
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74 1														
31.5 63		87	87	86	86	85	84	ø 2	8.2	34	81	9.2	84	85
125		73	78	81	52	83	82	82	93	34	63	81	82	52
250		82	81	75	76	76	75	77	78	79	79	78	78	77
500		83	82	83	77	73	79	76	3.0	78	73	77	80	79
1000		80	78	7.8	75	72	72	71	73	72	71	71	73	76
2000		75	76	74	71	63	66	6b	67	96	65	66	6,0	5.8
÷300		75	75	73	7 0	65	62	63	63	53	62	53	65	65
8000		70	70	68	66	53	58	5.9	58	58	57	50	61	60
		. 0	, ,	•		,,	,,		,,		٠,٠		31	0.0
OVERALL		71	90	89	38	<b>#8</b>	9.7	85	87	3.6	£7	36	8.6	38

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DISE SOUR	CE/SUBJECT:		OPERAT	I ON I			)					) 1E: ) PUI	ST 84-1 N 02	88-999
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NEAR FIE	LO NOISE LEVELS	t					)					)		
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	DISTANCE (M) ->	4	4	4	4	4	2	2	2	2	2	2	2	2
FREQ	ANGLE (DEG)>	260	280	300	320	340	0	20	40	60	80	100	120	140
(HZ)	CONDITION>	A	A	A	A	A	Α	A	A	A	A	A	A	4
31.5														
63		85	86	87	86	85	90	90	89	88	86	85	85	84
125		88	8 0	82	83	<b>61</b>	8.3	82	82	83	81	79	82	86
<b>25</b> 0		76	78	78	79	81	69	87	86	84	8 1	81	78	79
500		78	78	73	81	84	87	88	86	80	81	81	83	93
1000		73	75	76	78	78	٥5	84	82	77	76	76	75	76
2000		66	70	73	76	76	83	61	79	74	71	71	71	70
4000		55	67	70	73	76	81	79	77	71	6.5	67	67	67
8000		6ú	62	67	70	71	74	74	73	66	63	62	62	62

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	EASURFO SOUND PRI ECTAVE BAND	ESSU	PE LEVE	L (03)								) IDENTIFICATIONS ) ) OMEGA 3.2
MC-1 HEA	CENSUBJECT: TER, DUCT TYPE, LD NOISE LEVELS		OFERAT: 3400				) ) ) )					) TEST 8A-009-00 ) RUN 03 ) ) 25 JAN 82 ) ) PAGE J3
						LOCATI	ON/CON	DITION				
	DISTANCE (4)->	2	2	2	2	2	2	2	2	2	2	OPERATOR LUCATION
FREG	ANGLE (DFG)>	160	180	200	220	240	560	280	300	320	340	TEST CONDITION
(HZ)	CONDITION>	A	A	A	A	A	A	A	A	A	A	1/A
31.5												
63		45	86	87	85	86	٥7	07	88	88	88	92
125		89	89	8 6	56	85	84	81	81	32	8.3	93
25 0		33	85	5 →	01	8.0	8 0	81	81	94	87	92
500		83	8 3	87	85	81	82	81	50	92	87	8.8
1000		77	76	77	76	77	78	77	78	8 3	8 3	81
2300		70	69	71	71	71	72	73	75	8.0	83	75
4000		67	67	6.8	69	09	70	70	75	79	82	71
8300		63	62	<b>6</b> 3	54	64	64	64	69	73	74	66
OVERALL		32	92	93	91	90	90	90	90	32	94	98

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TABLE: MEASURES OF HE	IZ IOP NAML	E EXPOS	U <b>R</b> 5								) I DE	NTIFIC	ATIONS
3											) 041	EGA 3	• 2
												ST BA-	960-00
OISE SOURCE/SUBJECT:		DEERATI				)	1					N 01	
MG-1 HEATER, DUCT TYPE PORTABLE	't, (	3400	K P M								)	JAN 8	-
NEAR FIELD NOISE LEV	F1 5 1					,					1 23	JAN C.	
WEAR TIELD NOISE CCV.	(					i	,				PA	GE H1	
					LOCATIO	N/CON	DITION			• • • • • •			
DISTANCE (	M) -> 4	4	4	4	4	4	4	4	4	4	4	4	4
ANGLE (DEG)		23	40	60	80	100	120	140	150	180	200	2 <b>2 0</b>	240
CONDITION-	> A	A	A	A	Δ	A	A	A	A	A	Δ	Δ	Δ
AZARD/PROTECTION													
C-WEIGHTED OVERALL						•							
A-WEIGHTED OVERALL													
MAXIMUM PERMISSIBLE	E TIME (T	IN WIN	UTES)	FOR (	ONF EXP	SURF	PER DAY	(AFR	161-35	5. J'J_Y	73)		
NO PROTECTION		••											
OASLC OASLA	90 85	89 84	89 83	86	87 73	87 78	86 77	67 80	3 t 7 q	87 7 a	56 78	57 88	79
T	404	+83	571	900	75 960	460	950	960	960	960	960	960	960
MINIMUM OPL EAR HUFF:		400	2/1	900	960	450	300	900	450	36.0	300	960	460
OASLA*	5 65	64	64	64	6+	64	6.3	64	65	٤4	62	64	64
T	960	960	960	960	y60	360	33€	960	960	960	960	960	960
AMERICAN OPTICAL 170			,,,,	,00	,00	,,,	,,,,	,00	3.30	,00	,,,,	,,,,	,00
OASLA+	62	61	61	60	60	59	59	59	61	53	58	60	60
T	960	960	960	960	960	960	960	960	960	960	960	961	960
V-51R EAR PLUGS			•				• • •						
OASLA*	62	6.0	59	56	56	56	55	57	57	57	56	57	57
Ť	9 60	960	960	960	960	960	960	960	950	960	960	960	960
AMERICAN ADTECT: :	J EAR MUE	FS PLUS	V-51R	EAR	PLUGS								
AMERICAN OPTICAL 170:					_		42	43	44	4.5	42	43	44
AMERICAN OPTICAL 170: OASLA*	48	45	<b>46</b>	44	<b>4</b> 3	43	72					960	960
		46 960	46 960	950	960	960	960	960	960	960	960		
OASLA*	48 960	960				960		960		960	960		
OASLA* T H-133 GROUND COMMUNI( OASLA*	48 960 Cation Un: 59	960 IT 57	960 57	960 55	960 54	960 53	960 53	54	55	53	52	54	55
OASLA* T H-133 GROUND COMMUNIO	48 960 Cation Un:	960 IT	960	960	960	960	960					54 960	55 960
OASLA*  T  H-133 GROUND COMMUNI(  OASLA*  T  COMMUNICATION	48 960 CATION UN: 59 960	960 17 57 960	960 57 960	960 55 960	960 54 960	960 53	960 53	54	55	53	52		
OASLA* T H-133 GROUND COMMUNI( OASLA* T COMMUNICATION PREFERRED SPEECH II	48 960 CATION UN: 59 960 NTERFERENI	960 17 57 960 CF LEVE	960 57 960 L (PSI	950 55 960 L IN	960 54 960 D8)	960 53 960	960 53 960	54 960	55 960	53 960	52 960	960	960
OASLA* T H-133 GROUND COMMUNI( OASLA* T COMMUNICATION	48 960 CATION UN: 59 960	960 17 57 960	960 57 960	960 55 960	960 54 960	960 53	960 53	54	55	53	52		
OASLA*  T  H-133 GROUND COMMUNIC OASLA*  T  COMMUNICATION PREFERRED SPEECH IN PSIL	48 960 CATION UN: 59 960 NTERFERENI 80	960 17 57 960 CF LEVE 78	960 57 960 L (PSI 77	960 960 L IN 74	960 54 960 08) 73	960 53 960 72	960 53 960	54 960	55 960	53 960	52 960	960	960
OASLA*  T H-133 GROUND COMMUNI( OASLA* T COMMUNICATION PREFERRED SPEECH II PSIL ANNOYANCE PERCEIVED NOISE LET	48 960 CATION UNI 59 950 NTERFERENT 80 VEL, TONE	960 17 57 960 CF LEVE 78	960 57 960 L (PSI 77	960 960 L IN 74	960 54 960 08) 73	960 53 960 72	960 53 960	54 960	55 960	53 960	52 960	960	960
OASLA* T H-133 GROUND COMMUNIC OASLA* T CUMMUNICATION PREFERRED SPEECH II PSIL ANNOYANCE	48 960 CATION UNI 59 950 NTERFERENT 80 VEL, TONE	960 17 57 960 CF LEVE 78	960 57 960 L (PSI 77	960 960 L IN 74	960 54 960 08) 73	960 53 960 72	960 53 960	54 960	55 960	53 960	52 960	960	960

BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

TABLEE MEASURES OF I	HUMAN NUI:	E EXPOS	URE								) IDE	NTIFIC	ATIONS
3											) 041	EGA 3	.?
												ST BA-	000-00
OISF SOURCE/SUBJECT:		OPERATI				)						N 02	
MC-1 HEATER, DUCT T	YPE,	3400	RPM			,					, ,,		
PORTABLE NEAP FIELD NOISE LE	1515					•					) 25	JAN 8	2
NEWN FIELD NOTZE CE	AET2 (					,					) PA	GE H2	
					LOCATIO	N/CON	NOITION						
DISTANCE	(H) -> 4	4	4	4	4	2	2	2	2	2	2	2	2
ANGLE (DE	G1> 260	280	300	320	349	0	20	40	50	8.0	100	120	140
MOITICHOO	> A	A	Δ	A	A	A	Δ	A	4	A	4	A	A
AZARD/PROTECTION													
C-WEIGHTED OVERAL	L SOUND LI	EVFL (O	ISLC IN	0901	AT EA-	₹							
A-WEIGHTED OVERAL													
MAXIMUM PERMISSIB	LE TIME (	T IN MIN	UTES)	FOR (	ONE EXP.	SURE	PER DAY	(AFR	161-3	5, JU_Y	731		
NO PROTECTION													
OASLC	86	8.8	59	89	90	95	94	93	30	89	58	89	90
NASLA .	79	80	81	83	85	91	90	86	3.3	6.2	82	82	82
Т	960	960	807	5/1	404	143	170	240	571	679	679	679	679
MINIMUM APL EAR MUF	FS												
OASL 4 *	63	63	6+	55	<b>6</b> 6	70	69	68	56	6.5	64	65	57
Ť	960	960	963	960	960	960	460	900	950	àP 1	96 ü	960	950
AMERICAN OPTICAL 17													
OASLA#	90	6.0	61	61	62	56	65	64	<b>5</b> 3	61	50	61	62
Ť	960	960	960	960	961	960	360	960	950	960	960	960	960
V-51R EAR PLUGS													
OASL A*	57	57	57	59	61	66	65	54	<b>⇒</b> 0	59	<b>&gt;</b> 9	59	60
T	950	968	960	960	960	960	960	<b>760</b>	960	960	960	96 Q	960
AMERICAN OPTICAL 17													
OASLA*	44	44	45	46	47	52	<b>5</b> 2	<b>5</b> 0	+6	45	45	45	46
Ţ	960	160	960	960	900	96 B	960	960	960	960	950	960	960
H-133 GROUND COMMUN			_	_									
OA SLA *	54	55	50	58	59	64	62	61	58	56	55	55	56
T	960	960	<del>3</del> 60	960	950	960	960	960	950	960	960	960	960
	INTERFEREN										_	_	_
PREFERRED SPEECH			7 b	76	60	85	84	82	77	7ο	76	76	76
	73	74		_									
PREFERRED SPEECH PSIL ANNOYANCE	73												
PREFERRED SPEECH	73 EVEL, TONI			NLT ]	IN PNDBI	)							
PSIL ANNOYANCE PERCEIVED NOISE L	73 EVEL, TONI			NLT ]	IN PNO81	104	103	101	38	96	95	96	97

<sup>\*</sup> BASED ON GALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

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TABLES MEASURES OF HE	ZICH HAML	E EXPOS	URE								IDENTIFICATION
3										_	) ) DMEGA 3.2 ) Test 9A-000-002
NOISE SOURCE/SUBJECT: MC-1 HEATER, JUCT TYP		DEERATI				)					) RUN 03
PORTABLE	(	3400	ζι .,			í					25 JAN 82
NEAR FIFLD NOISE LEVE	ELS (					}					FAGE HT
					LOCATIO	04/C04	DITION				
DISTANCE (			2	2	. 2	2	2	2	2		OPERATUR LOCATION
ANGLE (DEG: CONDITION-			200 A	220 A	240 A	260	280 A	300 A	320 3	34 g	TEST CONDITION 1/A
00.1511150		-	-	-	-	-	-	-	7	-	***
HAZARD/PROTECTION											
C-WEIGHTED OVERALL											
A-HEIGHTED OVERALL											
MAXIMUM PERMISSIBLE	E TIME (T	IN MIN	UTESI	FOR (	ONE EXP	SURF	PER DAY	(AFR	161-3	5, JUL	¥ 73)
NO PROTECTION OASLC	92	92	93	91	93	9.0	9.0	90	32	94	97
OASLA	83	84	85	94	82	83	8.3	84	88	90	89
T	571	450	404	450	679	571	571	480	240	173	202
HINIMUH JPL EAR HUFF!		4,0	707	430	973	,, <u>,</u>	7.1	400	. 40		
OASLA+	69	69	7 0	68	67	ь́ь	65	65	67	6.9	74
7	960	960	960	960	960	96.0	960	960	960	96.0	960
AMERICAN OPTICAL 170	O EAR MUF	5									
OASLA#	64	65	62	63	63	62	62	62	63	65	70
T	950	960	960	96 ú	950	960	960	960	960	960	960
V+51R EAR PLUGS											
OASLA*	61	62	63	62	60	50	60	60	63	60	66
OASLA#	9 60	900	960	950	960	5 0 9 6 0	60 360	60 960	63 960	60 96 0	66 960
OASLA* T AMERICAN OPTICAL 170	950 DEAR MUF	900 FS PLUS	960 V-519	950 FAR	960 PLUGS	960	360	960	968	960	960
OASLA* T AMERICAN OPTICAL 170 OASLA*	960 0 EAR MUF 48	900 FS PLUS 48	960 V-519 49	950 FAR 47	960 PLUGS 45	960	360 46	960 46	96 <b>0</b> 50	96 0 5 1	960 53
OASLA* T AMERICAN OPTICAL 170 OASLA* T	950 0 EAR MUF 48 950	900 FS PLUS 48 960	960 V-519	950 FAR	960 PLUGS	960	360	960	968	960	960
OASLA* T AMERICAN OPTICAL 170 OASLA* T H-133 GFOUND COMMUNIC	960 0 EAR MUF 48 950 SATION UN	900 FS PLUS 48 960 IT	960 V-519 49 960	950 FAR 47 960	960 PLUGS +5 961	960 47 950	360 46 360	960 46 960	968 50 968	96 0 51 96 0	960 53 960
OASLA* T AMERICAN OPTICAL 170 OASLA* T	950 0 EAR MUF 48 950	900 FS PLUS 48 960	960 V-519 49	950 FAR 47	960 PLUGS +5 963	960	360 46 360 57	960 46	96 <b>0</b> 50	96 0 5 1	960 53
OASLA*  T  AMERICAN OPTICAL 1701  OASLA*  T  H-133 GFOUND COMMUNI(  OASLA*  T	960 0 EAR MUF 48 950 CATION UN 55	900 FS PLUS 48 960 IT 59	960 V-519 49 960	950 FAR +7 960	960 PLUGS +5 963	960 47 950 57	360 46 360 57	960 46 960 58	960 960 960	96 0 51 96 0 63	968 53 960 64
OASLA*  T  AMERICAN OPTICAL 170  OASLA*  T  H-133 GPOUND COMMUNI  OASLA*  COMMUNICATION	960 0 EAR MUF 48 950 950 CATION UN 55 960	900 FS PLUS 48 960 IT 59 960	960 V+51P 49 960 59	950 FAR 47 960 57 960	960 PLUGS 45 961 57 463	960 47 950 57	360 46 360 57	960 46 960 58	960 960 960	96 0 51 96 0 63	968 53 960 64
OASLA*  T  AMERICAN OPTICAL 170  OASLA*  T  H-133 GFOUND COMMUNI  OASLA*  T  COMMUNICATION PREFERRED SPEECH 11	950 0 EAR MUF 48 950 CATION UN 55 950 NTERFEREN	900 FS PLUS 48 960 IT 59 960	960 V+519 49 960 59 960	950 FAR 47 960 57 960	960 PLUGS +5 963 57 +63	960 47 950 57 960	360 46 960 57 960	960 960 58 960	960 960 91 950	960 51 960 63 960	960 53 960 64 960
OASLA*  T  AMERICAN OPTICAL 170  OASLA*  T  H-133 GPOUND COMMUNI  OASLA*  COMMUNICATION	960 0 EAR MUF 48 950 950 CATION UN 55 960	900 FS PLUS 48 960 IT 59 960	960 V+51P 49 960 59	950 FAR 47 960 57 960	960 PLUGS 45 961 57 463	960 47 950 57	360 46 960 57 960	960 46 960 58	960 960 960	96 0 51 96 0 63	968 53 960 64
OASLA*  T  AMERICAN OPTICAL 170  OASLA*  T  H-133 GFOUND COMMUNI  OASLA*  T  COMMUNICATION PREFERRED SPEECH 11	950 0 EAR MUF 48 950 CATION UN 55 950 NTERFEREN	900 FS PLUS 48 960 IT 59 960	960 V+519 49 960 59 960	950 FAR 47 960 57 960	960 PLUGS +5 963 57 +63	960 47 950 57 960	360 46 960 57 960	960 960 58 960	960 960 91 950	960 51 960 63 960	960 53 960 64 960
OASLA*  T  AMERICAN OPTICAL 1701 OASLA*  T  H-133 GFOUND COMMUNIC OASLA*  T  COMMUNICATION PREFERRED SPEECH 11 PSIL  ANNOYANCE PEPCELVED NOISE LET	960 O EAR MUR 46 950 CATION UN 55 960 NTERFEREN 77	900 FS PLUS 960 IT 59 960 CE LEVE 76	960 V-51P 49 960 59 960 L (PSI 78	950 FAR +7 960 57 960 L IN 78	960 PLUGS +5 963 57 963	960 47 950 57 960	360 46 960 57 960	960 960 58 960	960 960 91 950	960 51 960 63 960	960 53 960 64 960
OASLA*  T  AMERICAN OPTICAL 170 OASLA*  T  H-133 GFOUND COMMUNIC OASLA*  T  COMMUNICATION PREFERRED SPEECH 11 PSIL	960 O EAR MUR 46 950 CATION UN 55 960 NTERFEREN 77	900 FS PLUS 960 IT 59 960 CE LEVE 76	960 V-51P 49 960 59 960 L (PSI 78	950 FAR +7 960 57 960 L IN 78	960 PLUGS +5 963 57 963	960 47 950 57 960	360 46 960 57 960	960 960 58 960	960 960 91 950	960 51 960 63 960	960 53 960 64 960

<sup>\*</sup> SASED ON SALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

7	A 1/3	ASUKEJ S 3 OCTAVE STANCE =	BANC			.€ VEL	(60)										) } (	DMEG A		ION:
N	DISE SOUFCE MC-1 HEATE PORTABLE FAR FIELD	ER, DUCT	TYPE,			FATIO					) ) ) )	ETEORO TEMP BAK F REL H	RESS	= .76	29 C 51 P · 59 %	43	) ) )	PUN   25 JA! PAGE	01 N A2 2	
	FREQ								Δ.	SLE (	DEGR	FS1								
	(HZ)	0	10	20	30	<b>4</b> 0	50	60	70	30		100	110	123	130	1 <b>4</b> Ú	150	160	170	180
	25 31.5																			
	40								•	•			• • •		• • •					
	50 63	77< 77<	76 < 77 <	75< 76<	75 < 75 <	76< 76<	75<	74< 75<	74< 74<	74< 75<	74< 75<	73< 73<	73< 74<	72<	71< 73<		72<			
	80	,,,	77.5	164	154	/65	734	121	/ 4 \	150	130	13.	,	/ ) \	134		124			
	100	66<	67 <	70<	69<	70 <	70<	724	73	73	72	724	70<	66<	56<	70<	65<	65 <	67<	67 <
	125	72	70 <	764	71<	73	74	75	76	75	74	73	72	724	73	72	72<	71 <	71<	714
1	160	72	71	72	73	74	75	76	77	78	79	78	76	71	53<	71	74	75	76	75
l	200	73	71	70	69	68	69	70	70	7 C	69	6.8	9.0	63	55¢	55<	68	69	71	71
[	250	59	70	70	69	69	69	69	71	70	69	٤9	70	71	58	69	70	71	71	71
	315	7 1	68	67	67	68	69	70	70	68	67	67	67	66	56	67	58	68	69	68
	400	70	68	67	65	6+	6+	62	64	65	66	65	68	<b>b</b> +	67	€5	57	66	67	6.6
	500	50	65	69	70	53	66	e5	64	52	63	64	• 3	67	66	65	67	67	56	66
	630	73	68	67	55	65	64	65	64	<b>5</b> 3	63	٠÷	64	6+	65	65	63	62	62	63
	900	67	66	66	64	62	62	62	62	51	62	60	ė 1	61	52	€3	62	60	59	60
	1000	67	6.9	61	64	95	64	62	60	51	60	51	64	62	51	6.2	01	6.0	59	56
	1250	50	65	54	64	64	54	6.2	<b>b1</b>	>5	57	58	59	57	58	57	56	57	57	56
	1600	66	66	64	61	61	62	t 2	59	56	56	54	55	55	56	55	55	54	54	53
	2000	64	64	63	61	60	60	60	58	ž b	56	54	55	54	56	55	55	54	54	52
	2500	6.3	60	61	60	60	63	58	58 58	56 56	55 53	53 52	52	52	52	51	52	51	51	49
	3150	64	62 60	61	60	59 53	59	58	57	55	73 51	50	52 69	52	53 49	5.2	52	53	51	50
	4000 5000	6 <i>2</i> 61	60	61 60	60 60	58	59 58	57 55	55	53	71 50	49	49	43	49	49	49 49	49	49 47	48
•	6300	£.7	57	57	57	90 99	95 95	55 52	55 53	51	49	49	47	47	+6	46	47	46	46	45
	8000	59	59	59	59	54	55	55	55	52	48<	49	49	49<	494	464	46<	48<	46<	45
	10000	55	54	54	54	54	53	50 50	50	47 <	42<	43<	42<	424	424	424	+1<	41<	41<	39 <
		,,	74	24	74	/-	,	20	, ,	7	7	-5.	45,	41,	7.	76.	41.	7.1	41.	374
,	OVERALL	5.3	63	8.2	62	82	8.3	6.3	<b>b</b> 3	9.3	83	9.7	32	4.1	8.0	78	8.0	79	8.0	8.0

<sup>&</sup>lt; LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

A	EASURED SOUND NA OCTAVE BAN 1STANCE = 1	D		LEVEL	(60)										)	CENTIF D#FGA	FICATIONS
	RCE/SUBJECT:			FEATT						ETFOR					) 1		34-000-00
	TER, DUCT TYPE											• 2	24 C		;	0.1	, .
PORTABLE		,	i	3400					í					45		5 JAN	1 R 2
	D NOISE LEVEL	S	(						)			= 6	-		,		
			(						)						) (	PAGE	2
FRE?							A	IGLE									
(HZ)	190	236	210	220	231	240	253	260	270	280	290	303	310	320	330	340	350
25																	
31.5							75<	764	75<	78<	78<	78<	76<	77<	78<	74<	76<
40																	
50				73<								77<			76<		
63	73 <	72<	73<	74<	75<	76<	704	77 <	77<	77<	77<	77<	77<		76<	77<	
8.0														70<			734
100	62 <				65<		-	65<	67<		69<	65 <	_	62<	o3<		
125	71 <		71<	71 <	73	74	71<	71<	71<		72	71<	71<	71<	69<	68<	67<
160	74	74	72	69	70	12	69	69<	72	75	77	77	76	76	75	74	72
200	70	70	69	65	6 0	68	63<	64 <	65<		66<	07<	69	69	70	69	70
250	7 û	90	69	57	68	69	67	57	68	68	68	73	70	72	71	7 1	69
315	66	67	67	68	65	66	66	5 >	69	70	69	67	09	72	71	70	71
400	66	04	64	66	67	64	64	bō	62	66	66	04	67	67	57	67	68
500	67	66	67	67	67	t 3	62	0.4	65	64	63	64	64	66	66	66	66
630	62	62	61	64	62	£ 4	6+	66	65	65	65	5>	54	65	65	66	67
800	59	59	61	61	62	60	61	62	62	62	60	61	6.3	61	61	64	65
1000	<b>5</b> 9	60	61	61	60	61	61	62	63	64	60	6+	64	56	65	64	66
1250	56	59	60	58	53	F D	5.5	58	59	59	60	6.2	55	64	54	PE	65
1600	52	57	57	57	53	56	56	57	56	59	60	62	6 7	64	65	65	64
2000	54	5.5	55	56	<b>£</b> 5	55	56	54	57	59	59	61	62	6.3	<b>63</b>	6.3	64
2500	51	53	54	53	54	54	55	55	55	58	57	53	59	61	62	62	52
3150	52	53	54	54	53	54	55	55	56	57	59	60	51	63	64	64	65
4000	50	51	52	52	52	! 3	53	53	54	55	56	53	50	60	61	61	62
5300	49	49	50	50	49	50	49	51	53	54	56	57	58	59	51	61	62
6300	48	49	49	48	49	49	49	49	50	52	54	55	۶7	58	5 E	5 t	59
8000	48<		50	50	50	50	49	50	51	53	56	55	56	59	59	60	60
10000	43 <	46<	46<	47	45<	45<	45<	44<	45<	48	51	52	53	56	>5	55	55
OVERALL	80	30	3.0	8.0	51	8.2	£.2	33	6.3	84	34	34	34	8 🕶	84	8.3	84

<sup>&</sup>lt; LEVEL CORRECTED TO REHOVE BACKGROUND/ELEUTPUNIC NOISE.

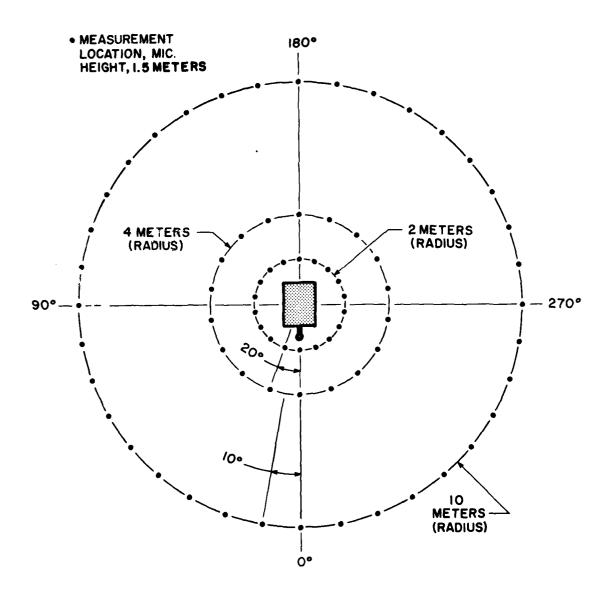
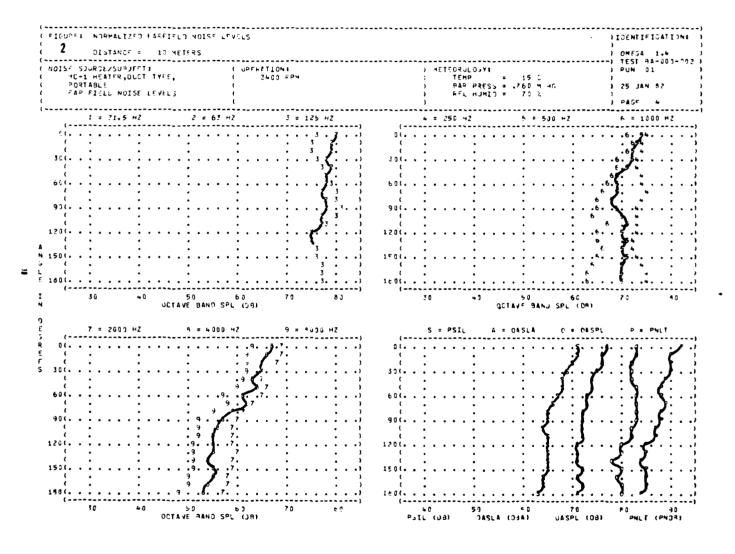


Figure 1. Measurement Locations

j

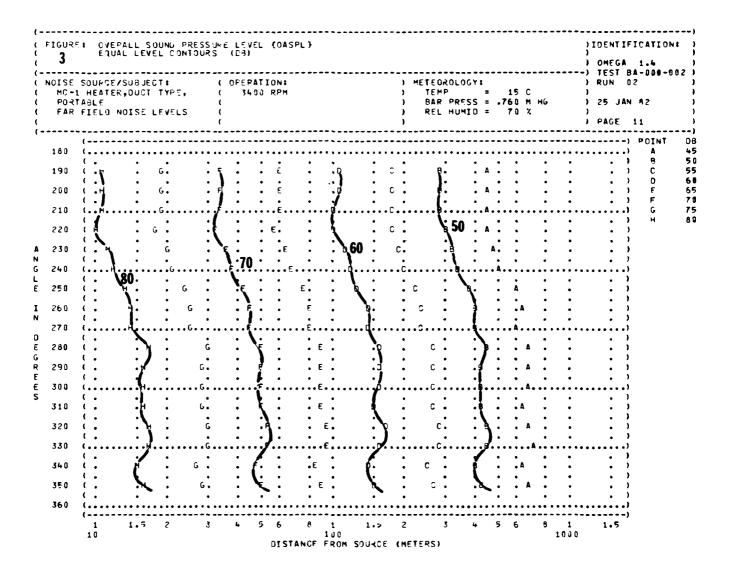


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2	DISTANCE =	FARFIELD NOISE LE			) IDENTIFICATION ( ) ) OMEGA 1.4 ) TEST 94-003-00
4C	SOURGE/SUBJECT -1 HEATER, DUCT RTABLE R FIELD NOISE	TYPE,	( )PEFLTION: ( 3400 FPM (	) METSORDLOGY! ) TEMP = 15 C ) 9AR PRESS = .760 M HG ) REL HUMID = 70 %	) RUN 32 ) 25 JAN 82 ) PAGE 4
	1 = 31.5 HZ	2 = <b>63</b> H	7 = 125 HZ	4 = 250 H7 5 = 500 H7	6 = 1000 <i>→2</i>
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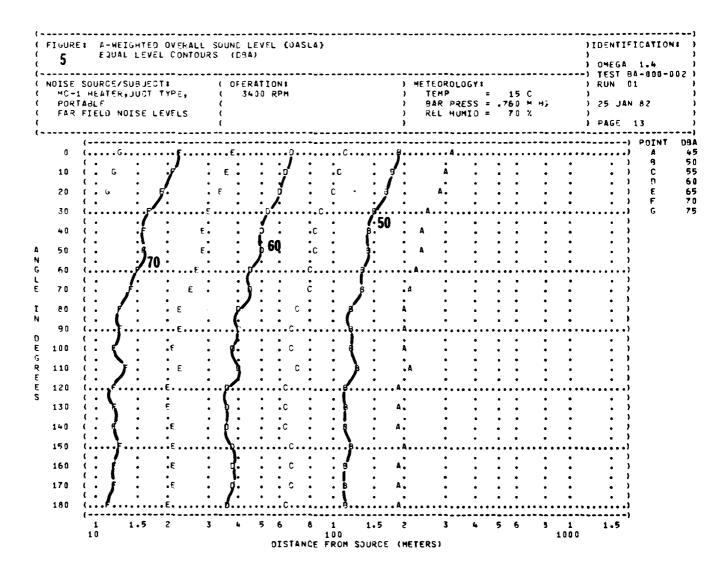


MC-1 PORT	HEA	TER,	DUCT SOLED	TYPE,	( (	3405	ION:				) :	EMP	RESS	=======================================	M H3	 ) OMEG: -) TEST -) RUN -) -) 25 Ji -) PAGE	84-000-00 01 An 82
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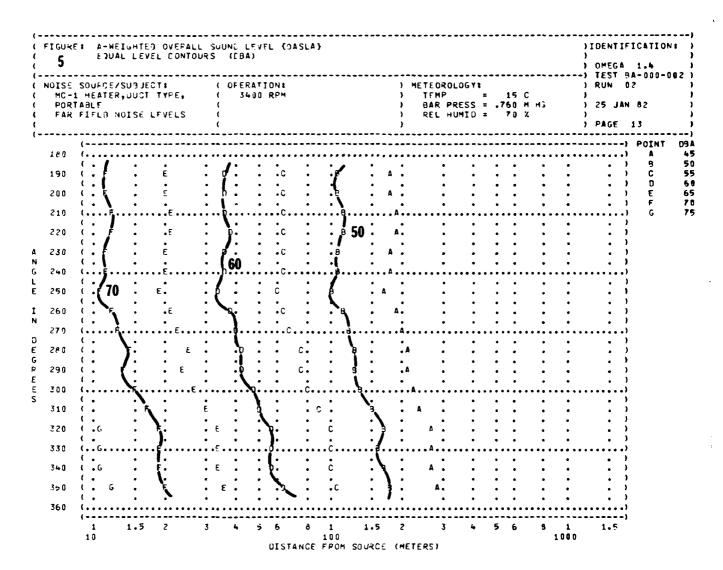
MC-1 PORT	SOURCE HEATE ABLF FIELD	R,JUCT	TYPE	-	( 0	FERA 340	TION D RP					) ) )	TER		: : 23:	7	15 C 60 M 70 %	H3			3 T ? )	1 82	<b>9 9</b> 2
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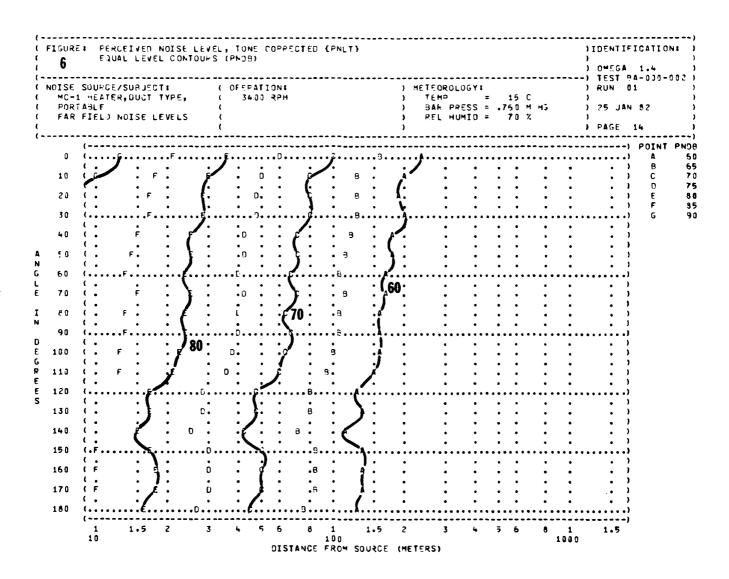
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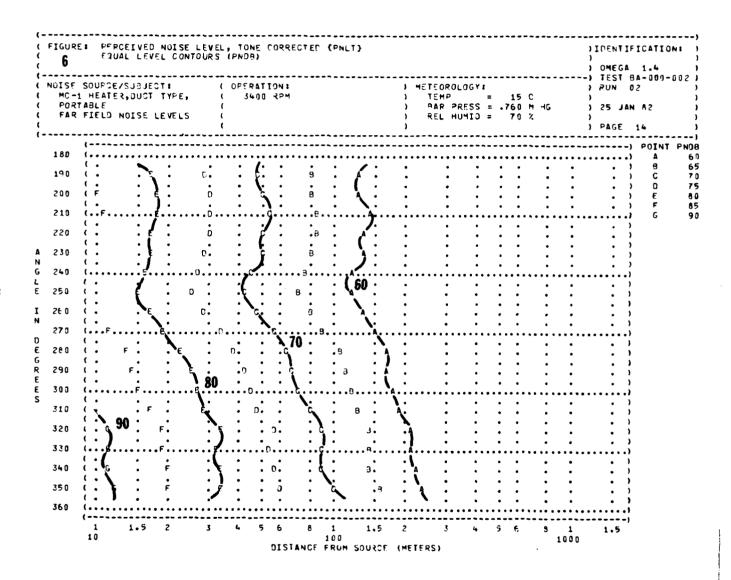
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110 ( .G	10	ISF SOURG MG-1 HEAT GRTABLE FAR FIELS	ER, DUC	TTYPE	, (	OFERA 340	FION: 0 RPM			) BA	MP R PRES	=	760 M H	13	-) TEST } RUN } ) 25 JA } PAGE	N #2
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MC-1 PORT	SOURCE/SU HEATER, J ABLE FIELD NOI	UCT TYPE	• (	FERATION: 3400 PPM		) ) ) )	METEOROLO TEMP BAP PRI KEL HUI	= 15 ESS = .760	м нз	) OMEGA -) TEST ! ) RUN   ) 25 JA! ) PAGE	94-000+0 02 N 62
220 230 240 250 250 270	(	60	E	50	. c	40	A				POINT  B C C C C C C C C C C C C C C C C C C
300 310 320 330 340 350	(	6 6 6		E	6	c	A.	A		. ]	

	OURCE/SUBJECT:	( OFFRATION: ( 3410 RPM		= 15 C	TEST PA-000+0 ) FUN 01
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49<	PERSONNE	. MAY BE EXPOSED UP TO	960 MINUTES PER DAY		i N
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60<	FOR ALL	ANGLES EVALUATED (INTIC	ATED BY < AT LEFT)		)
70<	UNDER THE	E FOLLOWING EAR PROTECT	ion conditions:		j 3
80<	NO !	PROTECTION			)
90<	MIN:	LMUM GPL EAR MUFFS			)
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( FIGURE) MAXIMUM PERMISSIBLE TIME (T) FOR ONE EXPLOSE: PER DAY (AFR 161-36, JULY 73) ) IDENTIFICATION: EQUAL TIME CONTOURS (MINUTES) 8 1 CMFGA 1.4 TEST RA-000-002 NOISE SOURCE/SUBJECT: ( OFERATION: ) METEOROLOGYS TEMP = 15 C BAP PRESS = .760 M H3 REL HUMIO = 70 % MC-1 HEATER, DUCT TYPE, 3400 RP4 PORTABLE 1 25 JAN 82 FAR FIELD NOISE LEVELS 180 190 < 200< 210 < >055 PERSONNEL MAY BE EXPOSED UP TO 960 MINUTES PER DAY 230 < AT ALL DISTANCES FROM SOURCE EQUAL TO OF GREATER THAN 1J METERS FOR ALL ANGLES EVALUATED (INDICATED BY < AT LEFT) 240< 250< UNDER THE FOLLOWING EAR PROTECTION CONDITIONS: 260 < NO PROTECTION MINIMUM CPL FAR MUFFS 270 < 280 < AMERICAN OPTICAL 1700 EAR MUFFS V-51R EAP PLUGS 290< 390 < COMFIT TRIPLE FLANGE FAR FLUGS 310< H-133 GROUND COMMUNICATION UNIT 320 < 330 < 340< 350 < 360 8 1 100 1.5 2 3 4 3 6 8 10 1000 DISTANCE FROM SOURCE (METERS)

(FIGUPT: SOUND PRESSUPE LEVEL (SPL)

(PAGE 1.4

(PAGE 1

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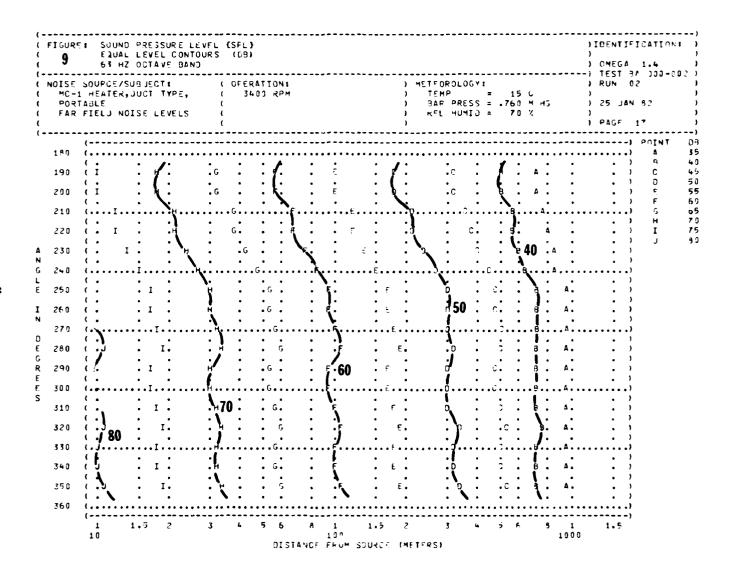
( FIGURE: SOUND PRESSURE LEVEL (SPL)
( 9 EQUAL LEVEL CONTOURS (EB)
31.5 HZ OGTAVE BAND ) IMENTIFICATIONS ) OMEGA 1.4 -) TEST 9A-000-002 ) PUN 01 ( NOISE SOURCE/SUBJECT: MC-1 HEATER, DUCT TYPE, ( UFERATIONS ) METECROLOGY: TEMP = 15 C BAP PRESS = .760 M H3 KEL HUHID = 70 % 3400 RPM PORTABLE FAR FIELD NOISE LEVELS ) 25 JAN 82 ) PAGE 16 NO CONTOUR DATA---FITHER NO INPUT DATA MERE COMPUTED (=3999.0) OR HINIMUM CONTOUR LEVEL REQUESTED IS GREATER THAN MAXIMUM COMPUTED LEVEL.

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MC-1 PORT	HEATE	ZSJBJEC R,JUCT NOISE L	TYPE,	( ( (		TIJNI			)			=	15 ( 00 (	<b>و ۲</b> ۰ ۳		-) T-ST } RUN ) ) 25 JA ) ) PAGE	N 67
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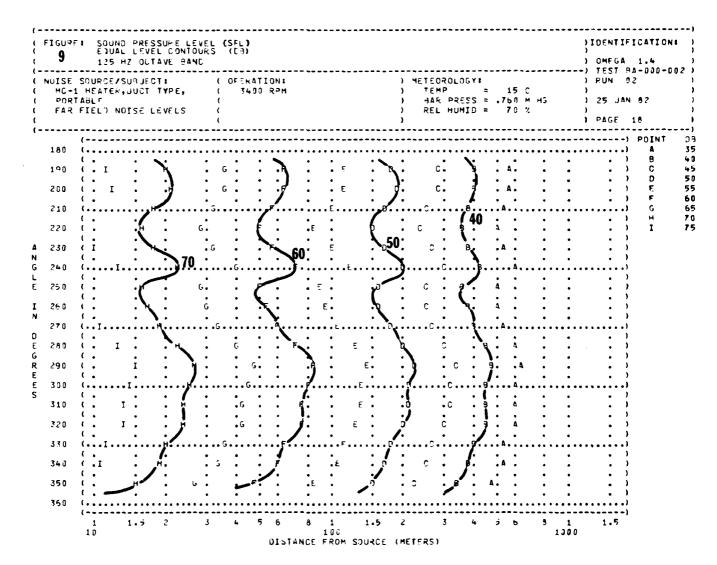
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			ANE	OFERAT	ION:					E OR OLO		15	. <b></b> .		) OMFGA -) TEST ) RUN	PA-039-00
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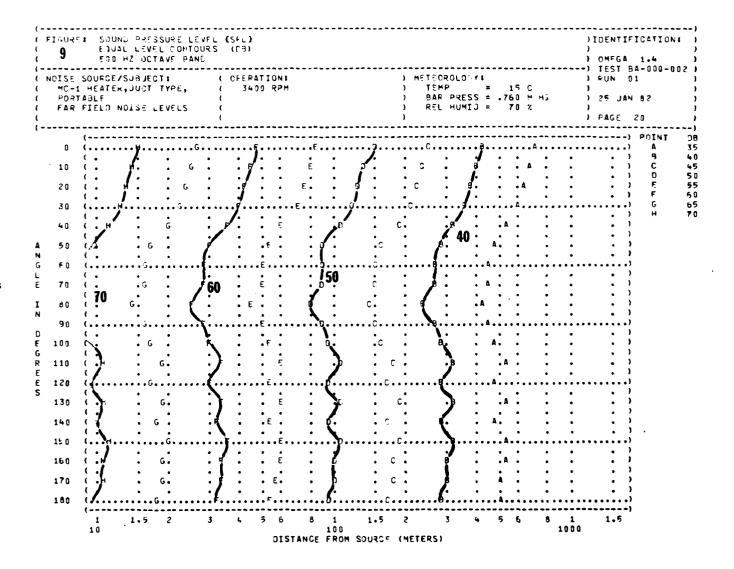
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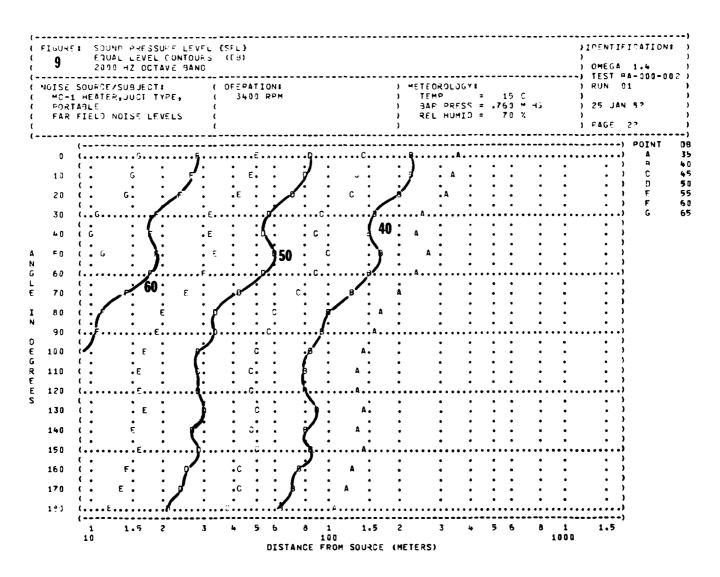
MC-1 PORT	1300 HZ UGTAVE SOUNCE/SUBJECT: HEATER, DUCT TYPE, ABLE FIELD NOISE LEVELS	( OPERATION: ( 34JD RPM			= 15 C = .700 M		) RUN ) ) 25 JA! ) FAGE	3A-000-00 N1 N 82
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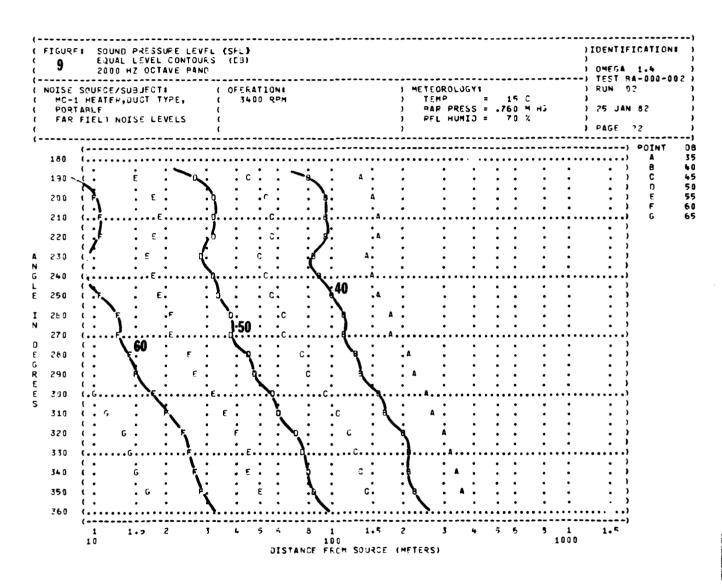
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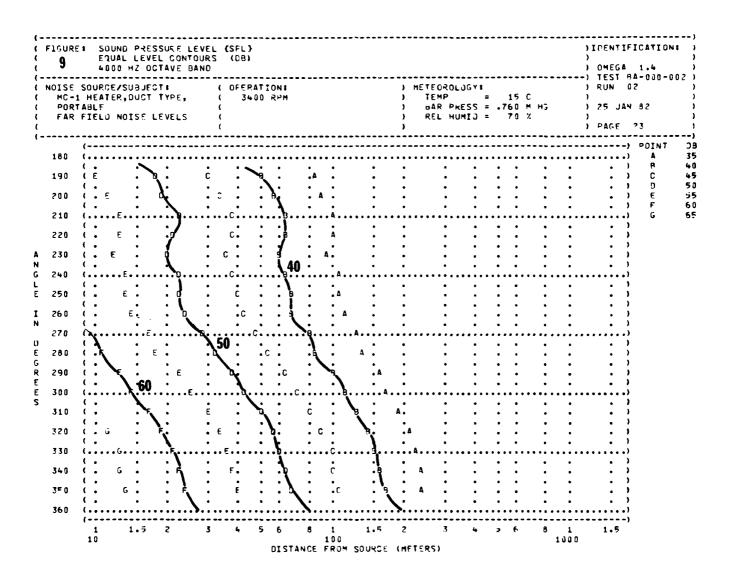


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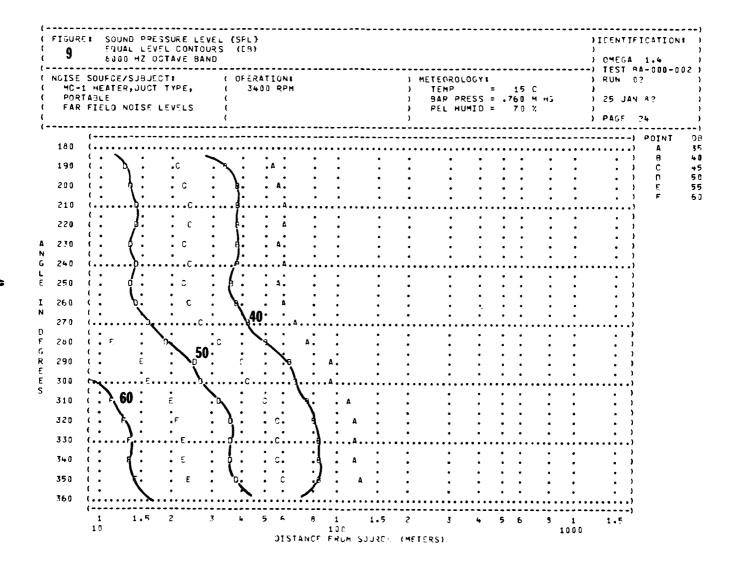


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MC-1 PORT	SOUPCE/SUBJECT: HEATEP, DUCT TYPE, ABLE FIELJ NOISE LEVELS	( OFERATION: ( 340) RPM (	) METEOROLOGY: ) TEMP = 15 C ) 98K PRESS = .760 M HG ) KEL HUMID = 70 %	-) TEST RA-000-002 ) RUN 01 ) 25 JAN 82 ) PASE 24
0	60 E	C A A A A A A A A A A A A A A A A A A A		) PASE 74
100 110 120 130		Α		- ) - ) - ) - ) - ) - ) - ) - ) - ) - )



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